

No.



9000153

# THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

**Pioneer Hi-Bred International, Inc.**

Whereas, THERE HAS BEEN PRESENTED TO THE  
**Secretary of Agriculture**

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED NOVEL VARIETY OF SEXUALLY REPRODUCED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF *eighteen* YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT (AT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

ALFALFA

'5472'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D. C. this 29th day of June in the year of our Lord one thousand nine hundred and ninety.

Attest

*Kenneth H. Evans*  
Commissioner  
Plant Variety Protection Office  
Agricultural Marketing Service

*Clayton Yentler*  
Secretary of Agriculture

U.S. DEPARTMENT OF AGRICULTURE  
AGRICULTURAL MARKETING SERVICE

APPROVAL EXPIRES 4-30-85

FORM APPROVED: OMB NO. C581-0065

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions on reverse)

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S) Pioneer Hi-Bred International, Inc.		2. TEMPORARY DESIGNATION XAL72	3. VARIETY NAME 5472
4. ADDRESS (Street and No. or R.F.D. No., City, State, and Zip Code) 7305 N. W. 62nd Avenue, P. O. Box 287 Johnston, IA 50131		5. PHONE (Include area code) 515-270-3340	FOR OFFICIAL USE ONLY VPVO NUMBER 9000153
6. GENUS AND SPECIES NAME <u>Medicago sativa</u>	7. FAMILY NAME (Botanical) Leguminosae		FILING DATE <u>Apr. 23, 1990</u> TIME <input type="checkbox"/> A.M. <input type="checkbox"/> P.M.
8. KIND NAME Alfalfa	9. DATE OF DETERMINATION September, 1985		FEE RECEIVED AMOUNT FOR FILING \$ <u>2150.-</u> DATE <u>April 23, 1990</u> AMOUNT FOR CERTIFICATE \$ <u>250.-</u> DATE <u>June 18, 1990</u>
10. IF THE APPLICANT NAMED IS NOT A "PERSON," GIVE FORM OF ORGANIZATION (Corporation, partnership, association, etc.) Corporation			
11. IF INCORPORATED, GIVE STATE OF INCORPORATION Iowa			12. DATE OF INCORPORATION 1926
13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS William T. W. Woodward, 7305 N. W. 62nd Avenue, P. O. Box 287, Johnston, IA, 50131 Jerry Chicoine, 700 Capital Square, 400 Locust Street, Des Moines, IA, 50309			

PHONE (Include area code):

14. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED

- a. ☒ Exhibit A. Origin and Breeding History of the Variety (See Section 52 of the Plant Variety Protection Act.)  
b. ☒ Exhibit B. Novelty Statement.  
c. ☒ Exhibit C. Objective Description of Variety (Request form from Plant Variety Protection Office.)  
d. ☒ Exhibit D. Additional Description of Variety.  
e. ☒ Exhibit E. Statement of the Basis of Applicant's Ownership.

15. DOES THE APPLICANT(S) SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED? (See Section 83(a) of the Plant Variety Protection Act.) ☐ Yes (If "Yes," answer items 16 and 17 below) ☒ No

16. DOES THE APPLICANT(S) SPECIFY THAT THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS? ☒ Yes ☐ No

17. IF "YES" TO ITEM 16, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED? ☒ Foundation ☐ Registered ☒ Certified

18. DID THE APPLICANT(S) PREVIOUSLY FILE FOR PROTECTION OF THE VARIETY IN THE U.S.? ☐ Yes (If "Yes," give date) ☒ No

19. HAS THE VARIETY BEEN RELEASED, OFFERED FOR SALE, OR MARKED IN THE U.S. OR OTHER COUNTRIES? ☒ Yes (If "Yes," give names of countries and dates) ☐ No

U. S. A. Spring of 1990

20. The applicant(s) declare(s) that a viable sample of basic seeds of this variety will be furnished with the application and will be replenished upon request in accordance with such regulations as may be applicable.

The undersigned applicant(s) is (are) the owner(s) of this sexually reproduced novel plant variety, and believe(s) that the variety is distinct, uniform, and stable as required in Section 41, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Applicant(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT PIONEER HI-BRED INTERNATIONAL, INC.	DATE 4/5/90
SIGNATURE OF APPLICANT BY: <u>William T. W. Woodward</u>	DATE 4/5/90

## EXHIBIT A

## ORIGIN AND BREEDING HISTORY OF THE VARIETY

'5472'

5472 is a sixteen clone synthetic with clones replicated in "cage isolation." Seed was harvested from each clone and bulked in equal quantities to produce Syn 1 prebreeder seed. Syn 2 seed harvested from 200 random plants in cage isolation in 1985, 1986 and 1987 is considered breeder seed. One or more of the parental clones were selected on the basis of clonal evaluation for forage and seed yield, bacterial wilt, Verticillium wilt, Phytophthora root rot, spotted alfalfa aphid, anthracnose and downy mildew. Parental clones trace back through several intermediate experimental lines to 532, Saranac AR, Vertus, Vernal, 530, Saranac, Culver, Scout, 520, WL202, Dawson, DuPuits, Arnim, MSA-W4, MSB-W4, Atra 55, Iroquois, WL305, and M. falcata x M. sativa. Clonal selection for forage yield was based on OP progeny row tests harvested over several locations.

During seed multiplication no variates beyond the limits defined under Exhibit C have been found. Multiplication procedures will insure that seed being sold as 5472 will not be shifted in characteristics beyond presently acceptable limits for alfalfa varieties.

It is confirmed that 5472 meets presently acceptable levels for uniformity for alfalfa varieties.

## EXHIBIT B

## NOVELTY STATEMENT

'5472'

5472 most closely resembles the variety '5364'. 5472 differs from 5364 in fall growth, being taller in field plots in the fall. See Exhibit D, Page 15.

OBJECTIVE DESCRIPTION OF VARIETY  
ALFALFA (*Medicago sativa* sensu Gunn et al.)

NAME OF APPLICANT(S) Pioneer Hi-Bred International, Inc.	TEMPORARY DESIGNATION XAL72	VARIETY NAME 5472
ADDRESS (Street and No., or R.F.D. No., City, State, and Zip Code) 7305 N. W. 62nd Avenue P. O. Box 287 Johnston, IA 50131		FOR OFFICIAL USE ONLY PVPO NUMBER 9000153

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place numbers in the boxes to designate the expressions which are characteristic of the commercial generations of the application variety. Data for quantitative plant characters should be based on a minimum of 100 plants. Include leading zeros when necessary (e.g., 0 8 9) for quantitative data. Comparative data should be determined from varieties entered in the same trial. Plant color may be precisely designated by using any recognized color chart, e.g., The Munsell Plant Tissue Color Charts.

1. WINTERHARDINESS:

8 CLASS:

- |  |                                      |
|--|--------------------------------------|
| 1 - Very Non-Winterhardy (CUF 101)           | 2 - Non-Winterhardy (Moapa 69)       |
| 3 - Intermediately Non-Winterhardy (Mesilla) | 4 - Semi-Winterhardy (Lahontan)      |
| 5 - (Du Puits)                               | 6 - Moderately Winterhardy (Saranac) |
| 7 - (Ranger)                                 | 8 - Winterhardy (Vernal)             |
| 9 - Extremely Winterhardy (Norseman)         |                                      |

TEST LOCATION: Owatonna, MN (See attached data for winterhardiness)

2. FALL DORMANCY:

FALL DORMANCY (DETERMINED FROM SPACED PLANTINGS)

TESTING INSTITUTION AND LOCATION	DATE OF LAST CUT	DATE REGROWTH SCORED	REGROWTH SCORE OR AVERAGE HEIGHT				LSD .05
			APPLICATION VARIETY	CHECK VARIETIES*			
				a) 526			
				b) Vernal	Ranger	Saranac	
Pioneer Hi-Bred Int'l Johnston, Iowa	9/15/87	10/15/87	13.6	a) 10.2	9.8	12.1	1.8
Pioneer Hi-Bred Int'l Johnston, IA	9/15/86	10/16/86	22.1	b) 16.2	17.1	18.9	1.8

\* CUF 101, Moapa 69, Mesilla, Lahontan, Du Puits, Saranac, Ranger, Vernal, or Norseman as appropriate.

Specify scoring system used: Average height in cm of space plants

5 Fall Growth Habit (Determined from Fall Dormancy Trials)

- |                            |                          |                            |
|----------------------------|--------------------------|----------------------------|
| 1 - Erect (CUF 101)        | 3 - Semierect (Mesilla)  | 5 - Intermediate (Saranac) |
| 7 - Semidecumbent (Vernal) | 9 - Decumbent (Norseman) |                            |

3. RECOVERY AFTER FIRST SPRING CUT (In Southwest, first cut after March 21):

3

- |                          |                    |                           |                   |
|--------------------------|--------------------|---------------------------|-------------------|
| 1 - Very Fast (CUF 101)  | 3 - Fast (Saranac) | 5 - Intermediate (Ranger) | 7 - Slow (Vernal) |
| 9 - Very Slow (Norseman) |                    |                           |                   |

TEST LOCATION: Owatonna, MN; Johnston, IA; Lancaster, PA; Connell, WA; Arlington, WI

4. AREAS OF ADAPTATION IN U.S. (Where tested and proven adapted):

6 Primary Area of Adaptation

2 1 Other Areas of Adaptation

- |  |                               |                  |
|--|-------------------------------|------------------|
| 1 - North Central                        | 2 - East Central              | 3 - Southeast    |
| 5 - Moderately Winterhardy Intermountain | 6 - Winterhardy Intermountain | 7 - Great Plains |
| 8 - Other (Specify) Northern part of 7   |                               |                  |



5. FLOWERING DATE (When 10% of plants possess open flowers at time of first spring cut):

Days Earlier Than

Same As

Days Later Than

1 - CUF 101

2 - Mesilla

3 - Saranac

4 - Vernal

5 - Norseman

TEST LOCATION:

## 6. PLANT COLOR (Determined from healthy regrowth 3 weeks after first spring cut, controlling leafhoppers if necessary):

☐

1 - Very Dark Green (524)

2 - Dark Green (Vernal)

3 - Light Green (Ranger)

COLOR CHART VALUE (Specify chart used): \_\_\_\_\_

APPLICATION VARIETY: \_\_\_\_\_

VERNAL: \_\_\_\_\_

TEST LOCATION: \_\_\_\_\_

## 7. CROWN TYPE (Determined from spaced plantings):

☐

Noncreeping Types:

1 - Broad (Vernal)

2 - Intermediate (Saranac)

3 - Narrow (ICUF 101)

Creeping Types:

4 - Creeping Rooted (Rangelander)

5 - Rhizomatous (Rhizoma)

## 8. FLOWER COLOR (Determine frequency of plants for each color class as defined by USDA Agricultural Handbook No. 424 (Barnes 1972), allowing all plants in plot to flower):

☐ 9 ☐ 1

% Purple and Violet (Subclasses 1.1 to 1.4)

☐ ☐ 8

% Blue (Subclasses 2.3 and 2.4)

☐ ☐ 1

% Variegated Other Than Blue (Subclasses 2.1, 2.2, 2.5 to 2.9)

☐ ☐ t

% Yellow (Subclasses 4.1 to 4.4)

☐ ☐ t

% Cream (Class 3)

☐ ☐ t

% White (Class 5)

TEST LOCATION: Johnston, IA

## 9. POD SHAPE (Determine frequency of plants with the following pod shapes produced on well cross-pollinated racemes):

☐ ☐ ☐

% Tightly Coiled (One or more coils, center more or less closed)

☐ ☐ ☐

% Loosely Coiled (One or more coils, center conspicuously open)

☐ ☐ ☐

% Sickle (Less than 1 coil)

TEST LOCATION: \_\_\_\_\_

10. PEST RESISTANCE: Provide in the appropriate column; trial data for application variety, and resistant (R) and susceptible (S) check varieties, synthetic generation tested, average severity index scores (ASI), least significant difference statistics (LSD .05), the institution in charge of test, year, and location of test, and whether test is a field or laboratory evaluation. Describe scoring system, and any test procedure which differs from standard methods proposed by Elgin (1982). Trial data from other test years or locations should be presented whenever available on a separate document as Exhibit D.

Seeds of the check varieties and germplasm lines listed below can be obtained from the USDA Field Crops Laboratory, Bldg. 001, Rm. 335, BARC-West, Beltsville, MD 20705. Although comparisons with check varieties listed below are preferred, comparisons with any appropriate check variety recommended by Elgin (1982) may be presented.

A. DISEASE RESISTANCE:	DISEASE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Anthracnose, Race 1 ( <i>Colletotrichum trifolii</i> )	Application (MR)		2	18.7	Approx. 150		% Resistant Plants 15.3	University of Wisconsin 1988 Madison, WI Laboratory
	Arc (R)			84.6	"			
	Saranac (S)			0.0	"			
	SCORING SYSTEM: % survival of 14 day old seedlings. Data adjusted to Saranac AR at 65% resistant plants by Pioneer Hi-Bred International, Inc.							
Anthracnose, Race 2 ( <i>Collectotrichum trifolii</i> )	Application							
	Saranac AR (R)							
	Arc (S)							
	SCORING SYSTEM:							
Bacterial Wilt ( <i>Corynebacterium insidiosum</i> )	Application (HR)		2	73.4	Approx. 225	1.71	0.47	University of Minnesota 1988 Rosemount, MN Field
	Vernal (R)			42.0	"	2.20		
	Naragansett (S)			15.4	"	3.26		
	SCORING SYSTEM: Plants scored 0 and 1 (on a 0-5 scale where 0=no disease and 5=dead plant) considered resistant. Data adjusted to Vernal at 42% resistant plants by the University of Minnesota.							
Common Leafspot ( <i>Pseudopeziza medicaginis</i> )	Application							
	MSA-CW3AN3 (R)							
	Ranger (S)							
	SCORING SYSTEM:							

DISEASE	VARIETY	TESTED	PERCENT PLANTS	PLANTS TESTED	ASI	LSD .05	FIELD OR LABORATORY
Downy Mildew ( <i>Peronospora trifoliorum</i> )	Application						
Isolate, if known:	Saranac (R)						
	Kanza (S)						
SCORING SYSTEM:							
Fusarium Wilt ( <i>Fusarium oxysporum</i> <i>f. medicaginis</i> )	Application (HR)	2	65.2	Approx. 225	1.85	0.65	University of Minnesota 1988 Rosemount, MN Field
	<del>Mendota (R)</del> MNGN-1 (S)		9.6	"	4.48		
	Narragansett (MR)		47.6	"	2.81		
	<del>Mendota (R)</del> Agate (R)		54.1	"	2.29		
SCORING SYSTEM: Plants scored 0 and 1 (on a 0-5 scale, where 0=no disease and 5=dead plant) considered resistant.							
Phytophthora Root Rot ( <i>Phytophthora megasperma</i> <i>f. medicaginis</i> )	Application (MR)	2	24.0	Approx. 225	4.09	0.66	University of Minnesota 1988 St. Paul, MN Field
	Agate (R)		43.0	"	3.40		
	Saranac (S)		6.9	"	4.62		
SCORING SYSTEM: Plants scored 1 and 2 (on a 1-6 scale, where 1=no disease and 6=dead plant) considered resistant. Data adjusted to Agate at 43% resistant plants by the University of Minnesota							
Verticillium Wilt ( <i>Verticillium albostrum</i> )	Application (MR)	2	24.0	-	3.65	0.45	University of Wisconsin 1988 Madison, WI Laboratory
	Vertus (R)		52.0		2.56		
	Saranac (S)		5.0		4.34		
SCORING SYSTEM: Plants scored 1 and 2 (on a 1-5 scale, where 1=no disease and 5=dead plant) considered resistant.							
Other (Specify)	Application						
	(R)						
	(S)						
SCORING SYSTEM:							
Other (Specify)	Application						
	(R)						
	(S)						
SCORING SYSTEM:							
B. INSECT RESISTANCE:	VARIETY	SYN. GEN. TESTED	PERCENT DEFOLIATION	DEFOLIATION IN PERCENT OF RESISTANT CHECK	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
INSECT	Application						
	Arc (R)			100			
	Saranac (S)						
SCORING SYSTEM:							
6 Aflata Weevil ( <i>Hypena postica</i> )	Application						
	Arc (R)			100			
	Saranac (S)						
SCORING SYSTEM:							

## 10. B. INSECT RESISTANCE (Continued):

INSECT	VARIETY	SYN. GEN. TESTED	PERCENT SEEDLING SURVIVAL	NUMBER OF SEEDLINGS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Blue Alfalfa Aphid ( <i>Acyrtosiphon kondoi</i> )	Application						
	CUF 101 (R)						
	PA-1 (S)						
	SCORING SYSTEM:						
Pea Aphid ( <i>Acyrtosiphon pisum</i> )	Application (HR)	2	56.3	Approx. 300		% Resistant Plants 25.1	Pioneer Hi-Bred International, Inc. 1988 Johnston, IA Laboratory
	<del>Kanza (R)</del> Baker (HR)		70.0	"			
	<del>Kanza (R)</del> Kanza (R)		13.2	"			
	<del>Kanza (S)</del> Vernal (S)		1.6	"			
SCORING SYSTEM: Plants scored 5-9 (on a 1-9 scale where 9=no symptom and 1=dead or severe stunting) considered resistant. Data adjusted to Baker at 70% resistant plants by Pioneer Hi-Bred International, Inc.							
Spotted Alfalfa Aphid ( <i>Therioaphis maculata</i> )	Application (R)	2	50.7	Approx. 300		% Resistant plants 31.1	Pioneer Hi-Bred International, Inc. 1988 Kerman, CA Laboratory
	Kanza (R)		70.0	"			
	Ranger (S)		22.6	"			
	SCORING SYSTEM: Plants scored 5-9 (on a 1-9 scale where 9=no symptoms and 1=dead plant or severe stunting) considered resistant. Data adjusted to Kanza at 70% resistant plants by Pioneer Hi-Bred International, Inc.						
INSECT	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Potato Leafhopper Yellowing ( <i>Empoasca fabae</i> )	Application						
	MSA-CW3An3 (R)						
	Ranger (S)						
	SCORING SYSTEM:						
Other (Specify)	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						
C. NEMATODE RESISTANCE:							
NEMATODE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Northern Root Knot ( <i>Meloidogyne hapla</i> )	Application						
	Nev. Syn. XX (R)						
	Lahontan (S)						
	SCORING SYSTEM:						



## 10. C. NEMATODE RESISTANCE (Continued):

NEMATODE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Southern Root Knot ( <i>Metoidogyne incognita</i> )	Application						
	Mospe 69 (R)						
	Lahontan (S)						
	SCORING SYSTEM:						
Stem Nematode ( <i>Ditylenchus dipsaci</i> )	Application (R)	2	69.2	Approx. 300	3.38	% Resistant Plants 20.8 ASI 0.58	Pioneer Hi-Bred International, Inc. 1988 Connell, WA Laboratory
	Lahontan (R)		60.0	"	3.80		
	Ranger (S)		9.9	"	1.77		
	SCORING SYSTEM: Plants scored 7-9 (on a 1-9 scale where 9=no disease and 1=dead plant) considered resistant. Data adjusted to Lahontan at 60% resistant plants by Pioneer Hi-Bred International, Inc.						
Other (Specify)	Application						
	(R)						
	(S)						
SCORING SYSTEM:							

## 11. INDICATE THE VARIETY THAT MOST CLOSELY RESEMBLES THE APPLICATION VARIETY FOR EACH OF THE FOLLOWING CHARACTERS:

CHARACTER	VARIETY	CHARACTER	VARIETY
Winterhardness	Vernal	Plant Color	-
Recovery After 1st Cut	Saranac	Crown Type	Saranac
Area of Adaptation	5432	Combined Disease Resistance	5364
Flowering Date	-	Combined Insect Resistance	Archer

## REFERENCES

- Barnes, D.K. 1972. A System for Visually Classifying Alfalfa Flower Color. U.S. Dep. Agric. Handb. 424. 18 pp. (Note: Greenish cast of plate 6, A and B is an artifact of printing, actual colors a blend of yellow and white.)
- Elgin, J.H., Jr., (ed.). 1982. Standard Tests to Characterize Pest Resistance in Alfalfa Cultivars. U.S. Dep. Agric. Tech. Bull. (In Press).
- Gunn, C.R., W.H. Skrdla, and H.C. Spencer. 1978. Classification of *Medicago sativa* L. using legume characters and flower colors. U.S. Dep. Agric. Tech. Bull. 1574. 84 pp.
- Munsell Color Co. 1977. Munsell Plant Tissue Color Charts. Munsell Color Co., Inc. Baltimore.

NOTE: Any additional descriptive information and supporting documentation may be provided as Exhibit D.

## EXHIBIT D

'5472'

APPLICATION FOR REVIEW OF ALFALFA VARIETIES FOR CERTIFICATION  
National Alfalfa Variety Review Board

(The criteria for evaluation of applications were developed by the Joint Alfalfa Work Conference and the Association of Official Seed Certifying Agencies.)

Applicant's Name:

Date: November 15, 1988

Pioneer Hi-Bred International, Inc.

Address: P.O. Box 287, Johnston, IA 50131

Sponsoring Institution (if other than applicant):

Breeder's name (if other than applicant):

Variety Name:

Experimental Designation: XAL72,  
YAL72, 85CR212

The breeder or sponsoring institution or organization must describe and DOCUMENT in this application those characteristics of the variety which give it distinctiveness and merit by supplying the information requested below. Information must be supplied for each category excepting those listed as optional. Action will be deferred unless the application is sufficiently documented.

- I. A. Estimate the % of the germplasm sources listed below that contribute to the major genetic constitution of this variety.

<u>M.falcata</u> 8	<u>Ladak</u> 9	<u>M.varia</u> 28	<u>Turkistan</u> 4	<u>Flemish</u> 44	<u>Chilean</u> 7	
<u>Peruvian</u>	<u>Indian</u>	<u>African</u>	<u>Arabian</u>	<u>Unknown</u>		

- B. A statement of origin (including variety names, germplasm releases and/or PI numbers, and the number of plants or % contribution from each) and the breeding procedures or methods and selection criteria used in developing the variety. Include the procedure for producing breeder seed, the generation (e.g. Syn 1, Syn 2, etc.) that is considered breeder seed, and the year of breeder seed production.

XAL72 is a 16 clone synthetic with clones replicated in "cage isolation". Seed was harvested from each clone and bulked in equal quantities to produce Syn 1 prebreeders seed. Syn 2 seed harvested from 200 random plants in cage isolation in -2-

-2-

1985, 1986 and 1987 was considered breeder seed. One or more of the parental clones were selected on the basis of clonal evaluation for forage and seed yield, bacterial wilt, Verticillium wilt, Phytophthora root rot, spotted alfalfa aphid, anthracnose, and downy mildew. Parental clones trace back through several intermediate experimental lines to 532, Saranac AR, Vertus, Vernal, 530, Saranac, Culver, Scout, 520, WL202, Dawson, DuPuits, Arnim, MSA-W4, MSB-W4, Atra 55, Iroquois, WL305, and *M. falcata* x *M. sativa*. Clonal selection for forage yield was based on OP progeny row tests harvested over several locations.

C. Seed classes to be used, limitations on age of stand and areas of production for each class.

Seed Class	Synthetic Generation	Length of Stand Allowed	Limitation on Areas for Seed Production
Breeder	2	Three	None
Foundation	3 or 4	Three	None
Certified	3, 4, or 5	Five	None

Only the synthetic generations given for the above seed classes are recognized as representing this variety. (No supporting data should be used in this application from Syn. generations other than those for the Breeder, Foundation and Certified classes listed here).

D. Procedures for maintaining seed stock:

Breeder seed (Syn 2) produced on 200 plants in cage isolation over a period of 3 years was bulked. Seed classes will be breeder, foundation and certified. Foundation seed may be produced from breeder or foundation. The second generation foundation seed may be produced at the discretion of Pioneer Hi-Bred International, Inc. Both breeder and foundation seed will be maintained by Pioneer Hi-Bred International, Inc. Certified seed may be produced from breeder or foundation seed.

E. Any other requirements or limitations necessary to maintain varietal characteristics?

None

II. A. Describe the primary use of this variety (if for uses other than hay, haylage, greenchop or dehydration):

B. List states and areas within states where tested for forage and/or persistence. (Present data from each location in IIIA and IIIB.)

Johnston, IA; Owatonna, MN; Toledo, IA; Tipton, IN; Phelps, NY; Lancaster, PA; Buckeystown, MD; Quarryville, PA; Hermiston, OR; Connell, WA; Moses Lake, WA; Davis, IL; Markesan, WI; Arlington, WI; Princeton, IL; Eau Claire, WI

C. Indicate proposed areas of adaptation and intended use on the map below.

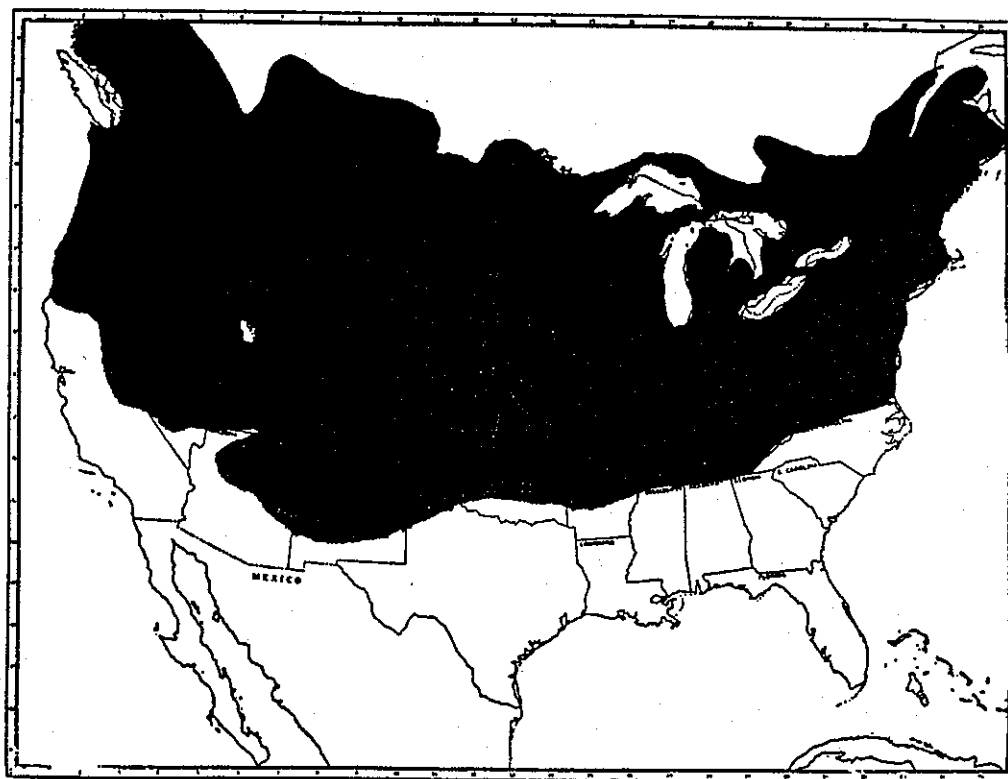
See map attached

III. Evidence of agronomic performance, including data on yield (in T/A) and persistence. Data may be from tests conducted by private firms, Agricultural Experiment Stations or USDA.

A. Minimum required forage yield data is six location years with at least two locations (two locations must be at least 100 miles apart). Seeding year forage yield data cannot be used to satisfy this requirement. One location must have at least two harvest years beyond seeding year. Each harvest year should be listed separately.

Note: For non-dormant varieties (dormancy level of Moapa 69 or CUF-101) seeding year data may be accepted for up to two of the six location years when four or more cuttings are made in the seeding year.

9000153



## Summarize Forage Yield Data below:

Test location	Date Plntd Mo/Yr	Syn Gen	Year Hvst	# Cuts	This Variety	Total Yield (DM T/A)			LSD .05	CV%
						2. <sup>a</sup>	3. <sup>b</sup>	4.		
Johnston IA	Spring 1986	2	1987	4	6.58	5.42	4.90		0.67	6.4
		2	1988	4	6.05	5.26	4.70		1.04	11.5
	Spring 1987	2	1988	4	5.79	4.90	5.01		0.96	10.9
Owatonna MN	Spring 1986	2	1987	3	6.64	6.21	5.04		0.91	9.2
		2	1988	3	4.65	3.86	3.53		0.74	11.1
	Spring 1987	2	1988	3	3.90	3.09	2.66		0.58	11.1
Toledo IA	Spring 1986	2	1987	4	7.76	6.38	6.60		0.86	7.4
		2	1988	4	5.83	5.30	4.71		0.68	7.8
	Spring 1987	2	1988	4	5.36	4.53	4.89		0.67	8.1
Tipton IN	Spring 1986	2	1987	3	5.40	5.67	5.56		1.04	13.1
Phelps NY	Spring 1986	2	1987	4	6.29	5.20	5.75		0.68	6.9
		2	1988	4	5.81	4.29	4.29		0.69	8.5
	Spring 1987	2	1988	2	4.82	3.82	4.32		0.43	5.9
Lancaster PA	Spring 1986	2	1987	5	5.99	4.29	5.06		0.82	9.2
		2	1988	5	7.71	5.63	5.70		0.94	8.6
	Spring 1987	2	1988	4	6.40	5.35	5.53		0.63	6.3
Buckeystown MD	Spring 1986	2	1987	5	6.63	4.48	5.72		1.04	9.9
		2	1988	5	7.22	5.58	5.79		0.93	8.1
	Spring 1987	2	1988	5	6.10	5.21	5.33		0.67	6.5
Quarryville PA	Spring 1986	2	1987	5	8.13	6.08	6.92		0.76	6.2
		2	1988	5	8.38	6.10	6.54		0.65	5.4
	Spring 1987	2	1988	5	7.63	5.36	5.99		0.27	4.8

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Hermiston OR	Spring 1987	2	1988	5	10.80	7.60	9.20	1.42	8.8
Connell WA	Spring 1986	2	1987	5	15.90	11.79	13.92	1.23	5.4
		2	1988	5	11.34	7.86	9.25	0.93	5.8
	Spring 1987	2	1988	5	11.92	9.53	11.46	0.69	3.7
Moses Lake WA	Spring 1986	2	1987	5	16.44	11.64	14.26	1.02	4.3
		2	1988	5	11.80	8.90	10.25	0.81	4.8
	Spring 1987	2	1988	5	11.66	9.61	10.15	0.40	4.6
Davis IL	Spring 1987	2	1988	1	3.06	2.85	2.97	0.28	5.8
Markesan WI	Spring 1986	2	1987	4	6.79	5.08	5.52	0.69	6.8
		2	1988	1	2.36	1.36	0.87	0.72	23.0
	Spring 1987	2	1988	4	4.03	3.12	2.70	0.77	14.8
Arlington WI	Spring 1986	2	1987	4	7.70	5.33	6.28	0.76	7.0
		2	1988	1	1.87	1.33	1.22	0.28	9.9
	Spring 1987	2	1988	4	6.20	5.37	6.25	0.78	8.2
Princeton IL	Spring 1986	2	1987	4	8.19	6.79	7.18	0.73	5.8
		2	1988	4	6.84	5.74	6.62	0.84	8.1
	Spring 1987	2	1988	5	8.93	7.26	8.18	0.85	6.3
Eau Claire WI	Spring 1987	2	1988	2	3.53	2.87	3.53	0.66	13.0

## Mean Annual Yield

	Years Hvstd	Total # of Hvsts				
Ck 2 comparison	40	159	7.21	5.65	X	
Ck 3 comparison	40	159	7.21	X	6.11	
Ck 4 comparison						

<sup>a</sup> Vernal  
<sup>b</sup> Saranac

- B. Persistence (winter and drought tolerance, summer survival relative to check varieties). Enter dates of both initial and Final stand estimates. Data must come from the area of adaptation and from stands at least two years old. More than one location must be given either when persistence is a trait used to justify release or when large diverse geographic areas of adaptation are recommended.

Test Location	Syn Gen	Date Seeded	Yrs. Hvtd	No. Hvts	Date of Readings Init/Final	This Variety <sup>a</sup> In/Fnl	% Stand Check varieties <sup>b</sup>		LSD .05	CV %
							In/Fnl	In/Fnl		
ZONE I	2	Spg 86	3	10/loc	Sum 86 Fall 88	100/ 104	100/ 102	99/ 87	1.9/ 5.6	2.0/ 6.1
ZONE II	2	Spg 86	3	12/loc	Sum 86 Fall 88	100/ 101	99/ 94	100/ 89	1.3/ 3.8	1.7/ 4.8
ZONE III	2	Spg 86	3	12/loc	Sum 86 Fall 88	100/ 106	98/ 91	99/ 96	1.5/ 6.1	1.4/ 6.0
ZONE IV	2	Spg 86	3	10/loc	Sum 86 Fall 88	99/ 102	100/ 94	100/ 86	1.2/ 5.6	1.3/ 6.0

**Scoring system used:** Data taken on missing six inch units within each plot with a total plot size = 120 units. Data is in % of mean from a zone means analysis with the following locations included in each zone:

ZONE I Johnston, IA; Owatonna, MN; Toledo, IA  
 ZONE II Phelps, NY; Buckeystown, MD;  
 Quarryville, PA; Lancaster, PA  
 ZONE III Connell, WA; Moses Lake, WA  
 ZONE IV Markesan, WI; Arlington, WI; Princeton, IL

<sup>a</sup> Vernal  
<sup>b</sup> Saranac



**WINTERHARDINESS**

Test conducted by Pioneer Hi-Bred International, Inc. at Owatonna, MN

Variety	Class	Year Tested	Syn Gen	Percent Survivors
This variety	Hardy	1986-87	2	62.1
1. Vernal	Hardy			69.1
2. 526	Hardy			78.3
3. Saranac	Moderately hardy			49.0
4. 555	Low hardy			40.8
	LSD (.05)			18.9
	CV (%)			23.0

**Scoring system used:** Plots seeded in 25' rows with six replications. Plots were hand thinned to leave plants spaced 1' apart (25 plants/plot). Date of last harvest = 9/1/86 with surviving plants counted the following spring.

**C. Fall dormancy relative to recognized varieties**

**1. Test data**

Test Location	Syn Gen	Date		Score or average height				LSD .05	CV %
		Last Cut	Date Measured	This Variety	check varieties	1.	2. <sup>c</sup>	3. <sup>d</sup>	
Johnston IA	2	9/15/88	10/19/88	22.1	<sup>a</sup> 16.2	17.1	18.9	1.9	8.0
Johnston IA	2	9/15/87	10/15/87	13.6	<sup>b</sup> 10.2	9.8	12.1	1.8	9.0

**Scoring system used:** Average height in cm of space plants; 20 plants/rep with 6 replications in 1988; 50 plants/rep with 4 replications in 1987

- <sup>a</sup> Vernal
- <sup>b</sup> 526
- <sup>c</sup> Ranger
- <sup>d</sup> Saranac

2. Indicate which of the following check varieties this variety most nearly compares to in fall dormancy.

<u>VERY DORMANT</u>	<u>DORMANT</u>	<u>MOD. DORMANT</u>	<u>NON-DORMANT</u>	<u>VERY NON-DORMANT</u>
Norseman ( )	Vernal ( )	Saranac (X)	Mesilla ( )	CUF 101 ( )
	Ranger ( )	DuPuits ( )	Moapa 69 ( )	
		Lahontan ( )		

D. Seed production (this information optional)

<u>Variety</u>	<u>Syn Gen</u>	<u>Test Location</u>	<u>Yrs. Tested</u>	<u>Average Yield (lbs/A)</u>
<u>This variety</u>				
1.	No information			
2.				

IV. Other descriptive characteristics

- A. Flower color at full bloom. Syn generation observed Syn 3  
(see USDA Agr. Handbook No. 424 - A system for visually  
classifying alfalfa flower color).

<u>91</u> % purple	<u>T</u> % cream	<u>T</u> % yellow
<u>9</u> % variegated	<u>T</u> % white	

- B. Growth habit: (erect, semi-erect or decumbent)

Mid summer	<u>erect</u>
Fall	<u>semi-erect</u>

- C. Optional: (Document distinctive characteristics such as  
pod, leaf or root traits, biochemical markers, etc.)

V. Pest Resistance Characteristics

Please follow these instructions carefully when reporting pest  
resistance results.

Furnish comparative data on the following insects and diseases (and others where applicable) for your variety. Data may be from tests conducted by private firms, Agricultural Experiment Stations, or USDA. Tests should be conducted by standard procedures as described in ARS Misc. publication 1434. Each disease and insect test must include recognized resistant and susceptible checks. Resistance levels should be characterized using % resistant plants as follows: S=<6%, LR=6-14%, MR=15-30%, R=31-50%, HR=>50%. Do not refer to tolerance. Checks should be characterized based on long term % resistance averages published in ARS Misc. publication 1434. If data for the resistant

check does not fit its expected resistance class (MR, R, HR, etc.) data must be adjusted to the long term mean. If data has been adjusted, supply both adjusted and unadjusted values and indicate how and by whom the adjustment was made. If a scoring or rating system is used, specify the limits and meaning of scores. Pest resistance data must be submitted on at least four of the following nine pests: anthracnose, bacterial wilt, Fusarium wilt, Verticillium wilt, Phytophthora root rot, stem nematode, pea aphid, spotted alfalfa aphid, and blue alfalfa aphid. For the pests where no data is available write "Not tested". The four required pests must be selected from those that frequently cause significant losses on susceptible cultivars in the area of proposed adaptation of this variety. (Use the map you have shaded in IIC and compare with the maps of distribution and severity of alfalfa pests in ARS Misc. publication 1434. This will determine for which pests you must submit resistance information.) Show generation of seed used for each test.

#### ANTHRACNOSE (Race 1)

Test conducted by University of Wisconsin at Madison, WI

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	MR	1988	2	14.5	18.7	
1. Sar AR	HR			50.5	65.0	
2. Arc	HR			65.7	84.6	
3. Saranac	S			0.0	0.0	
L.S.D. (.05)				11.9	15.3	
(.01)						
C.V. (%)				22.8	22.0	

Scoring system used: % surviving seedlings. Data adjusted to Saranac AR at 65% resistant plants by Pioneer Hi-Bred International, Inc.

# **BACTERIAL WILT**

Test conducted by University of Minnesota at Rosemount, MN

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	HR	1988	2	66.8	73.4	1.71
1. Vernal	R			38.2	42.0	2.20
2. Ranger	MR			28.4	31.2	2.57
3. Narragansett	S			14.0	15.4	3.26
L.S.D.	(.05)					0.47
	(.01)					
C.V.	(%)					13.6

Scoring system used: Plants scored 0 and 1 (on a 0-5 scale, where 0 = no disease, and 5 = dead plant) considered resistant. Data adjusted to Vernal at 42% resistant plants by University of Minnesota.

# **FUSARIUM WILT**

Test conducted by University of Minnesota at Rosemount, MN

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	HR	1988	2	65.2		1.85
1. Agate	R			54.1		2.29
2. MNGN-1	S			9.6		4.48
3. Narragansett	MR			47.6		2.81
L.S.D.	(.05)					0.65
	(.01)					
C.V.	(%)					18.8

Scoring system used: Plants scored 0 and 1 (on a 0-5 scale, where 0 = no disease, and 5 = dead plant) considered resistant.

## VERTICILLIUM WILT

Test conducted by University of Wisconsin at Madison, WI

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	MR	1988	2	24.0		3.65
1. Vertus	R			52.0		2.56
2. Saranac	S			5.0		4.34
3.						
L.S.D.	(.05)			13.0		0.45
	(.01)					
C.V.	(%)			23.3		10.4

Scoring system used: Plants scored 1 and 2 (on a 1-5 scale, where 1 = no disease and 5 = dead plant) considered resistant.

## PHYTOPHTHORA ROOT ROT

Test conducted by University of Minnesota at St. Paul, MN

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	MR	1988	2	15.01	24.0	4.09
1. Agate	R			26.87	43.0	3.40
2. Saranac	S			4.35	6.9	4.62
3.						
L.S.D.	(.05)					0.66
	(.01)					
C.V.	(%)					12.7

Scoring system used: Plants scored 1 and 2 (on a 1-6 scale, where 1 = no disease, and 6 = dead plant) considered resistant. Data adjusted to Agate at 43% resistant plants by University of Minnesota.

**STEM NEMATODE**

Test conducted by Pioneer Hi-Bred International, Inc. at Connell, WA

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	R	1988	2	22.9	69.2	3.38
1. Lahontan	R			19.9	60.0	3.80
2. Apalachee	R			19.7	59.4	3.56
3. Ranger	S			3.3	9.9	1.77
L.S.D. (.05)				6.9	20.8	0.58
C.V. (%)				38.0	38.0	14.0

Scoring system used: Plants scored 7-9 (on a 1-9 scale, where 9 = no disease, and 1 = dead plant) considered resistant. Data adjusted to Lahontan at 60% resistant plants by Pioneer Hi-Bred International, Inc.

**PEA APHID**

Test conducted by Pioneer Hi-Bred International, Inc. at Johnston, IA

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	HR	1988	2	46.0	56.3	
1. Kanza	HR			10.8	13.2	
2. Baker	HR			57.2	70.0	
3. Vernal	S			1.3	1.6	
L.S.D. (.05)				20.5	25.1	
C.V. (%)				35.0	35.0	

Scoring system used: % of plants surviving a mixture of pea aphids collected from Iowa, Minnesota, Wisconsin, and Pennsylvania. Data adjusted to Baker at 70% resistant plants by Pioneer Hi-Bred International, Inc.

**SPOTTED ALFALFA APHID**Test conducted by Pioneer Hi-Bred International, Inc. at Fresno, CA

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	R	1988	2	21.5	50.7	
1. Kanza	HR			29.7	70.0	
2. Baker	HR			32.0	75.4	
3. Ranger	S			9.6	22.6	
L.S.D.	(.05)			13.2	31.1	
	(.01)					
C.V..	(%)			35.0	35.0	

Scoring system used: Plants scored 5-9 (on a 1-9 scale, where 9 = no symptoms, and 1 = dead plant or severe stunting) considered resistant. Data adjusted to Kanza at 70% resistant plants by Pioneer Hi-Bred International, Inc.

**BLUE ALFALFA APHID**

Test conducted by \_\_\_\_\_ at \_\_\_\_\_

Variety	Resistance class	Year Tested	Syn. Gen.	Unadjust. % R	Adjust. % R	Score or A.S.I.
This variety	No information					
1.						
2.						
3.						
L.S.D.	(.05)					
	(.01)					
C.V.	(%)					

Scoring system used: \_\_\_\_\_

- VI. Summarize here the main advantages and characteristics of the variety. (Other than forage and seed yields.)

XAL72 is a winterhardy variety which has high resistance to bacterial wilt, Fusarium wilt, and pea aphid; resistance to stem nematode and spotted alfalfa aphid; moderate resistance to anthracnose, Verticillium wilt and Phytophthora root rot.

- VII. If this variety is accepted by official certifying agencies, when will certified seed first be offered for sale? \_\_\_\_\_

Spring, 1990

VIII. Plant Variety Protection

- A. Will application be made for PVP?

Yes ☒ No ☐ Undecided ☐

- B. If yes, will the application specify that the variety is to be sold by variety name only as a class of certified seed?

Yes ☐ No ☒

- IX. As a means of added varietal protection, are you willing to have the information herein turned over to the PVP office?

Yes ☒ No ☐

\_\_\_\_\_  
Signature of Applicant

At the time a variety is accepted for certification, a seed sample of the generation or generations requested by the certifying agency shall be submitted to the certifying agency by the sponsor. This lot(s) is to be retained as a control sample against which all future seed stocks released for certified seed production may be compared to establish continued trueness of variety.



1989 FALL HEIGHT FROM YIELD TEST PLOTS SEEDED  
IN 1988 OVER 14 LOCATIONS.

<u>Test Locations</u>	<u>No. Reps</u>	<u>Date Seeded</u>	<u>Years Harvested</u>	<u>Fall Height in % of Mean</u>		<u>LSD .05</u>	<u>CV %</u>
				<u>5364</u>	<u>5472</u>		
Zone I	9	Spring 1988	2	103	124	16.8	12.9
Zone II	9	Spring 1988	2	95	114	15.4	12.0
Zone III	9	Spring 1988	2	110	138	25.0	19.9
Zone IV	13	Spring 1988	2	100	149	20.3	19.3

Visual scores with 9=tall and 1=short. Data reported in % of mean from a zone means AOV.

Zone I = Johnston, IA; Owatonna, MN; Toledo, IA

Zone II = Lancaster, PA; Quarryville, PA; Phelps, NY

Zone III = Hermiston, OR; Connell, WA; Moses Lake, WA

Zone IV = Davis, IL; Arlington, WI; Princeton, IL; Markesan, WI; Appleton, WI

## Exhibit E

## STATEMENT OF THE BASIS OF APPLICANT'S OWNERSHIP

'5472'

Pioneer Hi-Bred International, Inc., Des Moines, Iowa, is the employer of the plant breeders involved in the development and evaluation of 5472. Pioneer Hi-Bred International, Inc. has the sole rights and ownership of 5472.